PROGRESS REPORTS

FROM

EXPERIMENT STATIONS

SEASON 1957-58

SURVEY OF REPORTS

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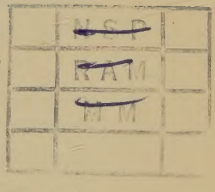

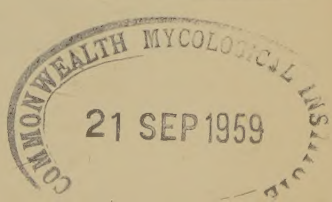

PROGRESS REPORTS FROM EXPERIMENT STATIONS. SEASON 1957-58

A full list of the reports published for the season 1957-58 is given below; the price post free is 7/6d. for the set, or 1/- each for individual reports.

1. Uganda.
2. Kenya.
3. Tanganyika—Lake Province.
4. „ —Eastern Province.
5. Nyasaland.
6. Northern Nigeria.
7. Republic of the Sudan.
8. Aden.
9. West Indies.
10. Survey of Reports for 1957-58.

SURVEY OF PROGRESS REPORTS
FOR THE SEASON 1957-58

BY

D. F. RUSTON.

General.

The overseas staff of the Corporation, by agreement with the Governments concerned, continued to work in the same eight territories as before, namely, Uganda, Kenya, Tanganyika, Nyasaland, Northern Nigeria, the Republic of the Sudan, Aden and the West Indies. The number of staff increased during the year, from 36 at 31st March 1958 to 42 at the same date in 1959.

At the Cotton Research Station at Namulonge in Uganda, which is owned, staffed and operated by the Corporation, there is a complete Corporation research team covering plant breeding and genetics, pathology, entomology, physiology, agronomy, soil science and statistics. Officers at this station study long-range problems applicable to all cotton growing territories as well as investigating short-term projects to increase cotton production in Uganda.

In all the other territories in which the Corporation's staff are stationed, and at Serere in Uganda, Corporation officers work on Government Stations and form a part of the Department of Agriculture's research team. By working on Government Experiment Stations the Corporation's staff are able to co-operate to the fullest possible extent with the Departments of Agriculture, and where necessary they also assist in extension work. The importance of extension work ranks high, as research and experimentation can produce no real benefits until their results have been put into practice.

The success of the work of the Corporation and the Departments of Agriculture owes much to co-operation at all levels. At Namulonge, for example, the physiologists, soil scientists and entomologists are all co-operating on a supplementary water experiment; physiologists and entomologists are working together studying *Lygus* damage; and the success of the plant breeders in producing strains resistant to disease owes much to the techniques which have been worked out for them by the pathologists.

Elsewhere, another example of co-operation comes from Samaru in Northern Nigeria, where the Corporation's entomologist has produced for the Ministry of Agriculture an illustrated booklet showing the steps which should be taken to increase the yield per acre. Copies of this booklet are to be distributed to farmers, and it is hoped that it will lead to a further increase in cotton production.

For the season 1957-58 work continued on the main lines laid down previously. Further progress was made in the multiplication of the new and higher yielding varieties in Uganda, Tanganyika, Nigeria and Nyasaland, and the important soil moisture studies initiated at Namulonge were extended to Aden, Nigeria and Nyasaland.

It is becoming increasingly evident that the use of insecticides to control insect pests will be economic only where the yield potential is high. This in itself is beginning to have an effect on farming practice, and it has already been noticed, particularly in the Eastern Province of Tanganyika and in parts of Nigeria, that the gradual introduction of the use of insecticides is raising the standard of cultivation.

The rapid drop in cotton prices during the year, and the considerably reduced differentials between short, long and extra-long staples, have made some territories investigate the possibility of growing shorter stapled cotton on part of the area. In general, shorter and coarser cottons will normally give a higher yield than longer and finer ones, and a balance must therefore be drawn between price and yield. The experiments with different types of cotton which form part of the Corporation's programme may in the future prove useful to the Departments of Agriculture when they are reaching their decision on the types to be grown.

Uganda.

Cotton Research Station, Namulonge.

The first of the new BP52 multiline issues—NC54—was grown on 34,000 acres and produced sufficient seed to cover the whole of the BP52 area for 1958-59.

In district variety trials the best BP52 selection gave a 20% lint increase over local BP52, whilst Albar was even better, with a 42% increase. This strain, however, with its high standard hair weight, is not a direct competitor with BP52 from the point of view of quality.

As a result of tests carried out over a number of years it has been concluded that a less favourable water régime is the main factor responsible for lower yields from late planted cotton. Water stress occurring at a critical stage in development can check further fruiting point production as well as the development of leaf area. Irrigation equipment was therefore installed at Namulonge to enable the onset of water strain to be delayed or obviated experimentally and to help to determine the rôle of water in the vegetative and fruiting habits of the plant. This work is being carried out in conjunction with the soil science section and results of much interest have already emerged. In 1957-58 raingrown cotton at Namulonge was poor, the average yield being 481 lb. seed cotton per acre. Ten inches of supplementary water raised this yield by 570 lb. and a further five inches increased the yield

by another 120 lb. Investigations are also being made into the stomatal behaviour of both raingrown and irrigated cotton. Supplementary water appears to increase the effects of nitrogen and phosphate and also allows closer spacing.

Investigations in the soil science section show that continuous cropping, particularly with two crops a year, soon leads to a decrease in organic matter and a decline in fertility, phosphorus being one of the first nutrients to be lost.

A DDT/toxaphene mixture sprayed to runoff at weekly intervals was effective in controlling both *Lygus* and bollworms, but, as in previous years, the development of a secondary crop evened up final yields, the only difference between the sprayed and unsprayed cotton at the end of the season being in the time of crop production, the sprayed being considerably earlier than the unsprayed.

In the pathology section the emphasis was on seed dressing, and in general it was found that, as expected, the organic mercurial compounds were the most efficient.

Serere.

In district variety trials the most promising variety was the BP52 strain C(50)20, which gave an average lint increase of 20% over local S47. DE715/6M, the new commercial variety, which is considerably less neppy than S47, gave an average increase of 14%.

There was little difference in final yield between plantings made in mid April and mid May, but plantings in mid July showed a reduction of up to 50%. With April and May plantings a DDT spray increased yield by 50%.

In three out of eight cultivation trials flat cultivation significantly out-yielded ridge cultivation. The other five trials gave non-significant results.

Kenya.

The Departmental cotton campaign in Nyanza Province was successful in increasing acreage, but unfavourable rainfall distribution, combined with late planting in certain areas, resulted in a fall in average yield to just under 48 lb. lint per acre. Bacterial blight was again the most prevalent disease, with *Verticillium* wilt occurring in isolated areas.

A series of insecticide trials to control stainers was carried out on commercial cotton crops in South Nyanza. Yield increases of from 22% to 68% were achieved by the use of dusts, the most suitable being 3% gamma BHC plus 10% DDT, applied at the rate of 16 lb. per acre on four occasions. This treatment gave an average yield of 687 lb. seed cotton per acre, or 280 lb. more than the control. The amount of

A grade cotton was also increased by the use of insecticides. These trials again show that insecticides are of use only when reasonable yields could be obtained in the absence of insect pests.

In the Coast Province the Tanganyika varieties Uk51 and Uk55, both with good resistance to jassid, significantly out-yielded N17, which has negligible resistance.

Tanganyika.

Lake Province.

In 1957-58 the whole Province was planted to Uk51, apart from a small area where Uk55 was being multiplied.

In recent seasons cotton production in the Lake Province has increased almost fivefold, the main reasons for the increase being as follows: —

1. A succession of new seed issues, the effects of which are probably greater in the field than in small plots.

2. The introduction of seed dressing to control bacterial blight. Again there is evidence that seed dressing is more effective in the field than is shown in small-scale controls.

3. The effect of the agronomic advances advocated at Ukiriguru, such as the use of manures, land resting, tie ridging and early planting and weeding.

Three breeding programmes are being carried out at Ukiriguru; a straight selection of local material; selection within Albar 51 hybrids; and crosses between local varieties and Sudan varieties containing the gene B_{om}. The Albar hybrids are yielding well up to the standard of Uk55 and are showing better resistance to stem and boll forms of bacterial blight. Improvement in other characters is still required.

As a result of seed treatment trials it has been recommended that the rate of application should be increased from 1:250 w/w to 1:200.

Fusarium wilt seems to be associated with soil types occurring round the lake. Resistant varieties from U.S.A. and the Belgian Congo have been tested, but these imported types went down badly with jassid and are of doubtful value as resistant parents. A search is therefore being made for resistance in strains already adapted to the local environment.

Eastern Province.

There has been increased interest in cotton and a post-war record crop of 15,000 bales was harvested.

In district variety trials Il58, which is being multiplied to replace 47/10, gave a seed cotton increase of 12% and also a higher ginning outturn. Spinning tests confirmed the generally superior yarn strength of Il58. The main aim of the breeding programme is to produce a

high yielding variety with good jassid resistance, early maturity and improved ginning outturn.

Cotton is being tried at three farms in the Rufiji basin irrigation scheme. The slow fruiting Sudan types do not seem suitable and gave considerably lower yields than local East African cottons.

In insecticide trials the best results were obtained from the DDT plus malathion treatments, the latter giving additional control of bollworm as well as checking aphid build up. Where growth was very luxuriant, making the application of insecticides difficult, a trial was carried out using double rows of cotton 1 ft. apart followed by a gap of 6 ft. down which the insecticide equipment could pass. This method gave in 1957-58 as good yield as regular spacing in rows 3 ft. 6 in. wide (giving the same number of plants), and greatly facilitated both dusting and harvesting.

Spray treatments, including the use of new formulations not yet on the market, gave promising results.

Nyasaland.

Albar 637 is being multiplied to replace the present commercial variety CLB. The following variety trial results (lb. lint per acre) show its increased yield.

	CLB.	*Albar 637.*
Makanga	84	124
Ngabu	150	301
Chitala	228	296
Lower River	272	328

Weekly samples showed a steady rise in ginning percentage through the season—from 31·5% at end April to over 37% in early June. The accompanying fall in seed weight did not fully account for the increased percentage.

Preliminary tests were made to obtain information on the possible yields of a variety of crops under irrigation and to seek the best method of applying the water. Work on soil moisture was continued, using the techniques developed at Namulonge.

The effects of growing conditions on quality are illustrated by the following figures, which show that the more difficult growing conditions led to a marked reduction in length and strength.

Cotton grown on:—	*Effective length.*	*Fibre strength.*	*C. × S.*
Best flood land	39	21·2	2239
Best dry land	38	19·3	2000
Medium dry land	36	19·4	1833

Red bollworm was severe in Karonga and (with American bollworm) in the Central Areas. Pest damage was light in the Lower River, but in spite of the absence of stainer, 18% of the crop was grade 2, mainly as a result of bollworm.

Northern Nigeria.

Early planting, with favourable weather thereafter, helped to ensure a record crop both in terms of total lint (240,000 bales) and in production per ton of planting seed issued (15 bales). In the absence of reliable data on which average yield per acre can be calculated, this figure of bales of lint per ton of planting seed serves as the best indication of the success of the crop. The figure of 15 bales reached this season compares with a previous record of 12½ bales in 1954-55.

The programme of straight reselection in Allen and imported types continued, but none of the selections from imported types showed any advantage over local selections. The Allen material still contains ample variability and could respond to selection for increased strength—should that prove desirable—without loss of yield. In eleven variety trials throughout the cotton belt the blend of 26J substrains chosen to form the third wave 26J gave 6·5% more lint than second wave 26J, whilst individual strains gave increases of nearly 25%. The season was favourable for multiplication and seed stocks of 26J, which represented only 2·8% of the total seed requirement of the country at the beginning of the season, were built up to over 14% by the end. By 1959-60 at least 60% of the cotton area should be under 26J.

Preliminary tests suggest that treatments which result in holding extra water on the land at the height of the rains (mulching, cross tying, etc.) may in some seasons and in some areas have harmful results. The response to water conservation appears to depend at least partly on the level of fertility. A very small-scale experiment on supplementary watering gave interesting results. Plots planted in early July showed no response to extra water, but cotton planted twelve days later, which yielded 25% less than early planted cotton when not watered, gave a 25% increase when watered, thus bringing the yield level up to that of the early planted.

The overall mean of six time-of-planting experiments over three years was:—

19th June	108%
3rd July	100%
17th July	73%
31st July	58%

The incidence of bacterial blight was well above average and consequently seed dressings proved profitable. Though not likely to

show a profit every year they are recommended as an insurance against a bad attack.

The favourable conditions and long growing season compensated to a certain extent for the damage done by pests.

Insecticide trials were designed chiefly to control stainer and consequently they were carried out mainly in the Riverain Provinces where the pest is predominant. Partial control of bollworm was also achieved. Six applications at weekly intervals of 1 lb. DDT plus 0·3 lb. gamma BHC per acre from early September to mid October should give an economic increase, as the cost—£7 10s. 0d. per acre—would be covered by an increase in yield of 350 lb. seed cotton.

Republic of the Sudan.

The season was exceptionally unfavourable and this considerably retarded the normal development of the research and experimental programmes. In comparison with the previous year, total rainfall was 117 mm. less and average maximum temperatures 5·5°F. higher, so that the season was excessively hot and dry. In addition, pests and diseases came in early and built up rapidly and, in the words of the report, "Apart from the absence of blackarm, every circumstance militated against healthy growth and ultimate yield".

Testing of new introductions continued. MSI, from the West Indies, appeared to be more resistant to leafcurl than BAR 14/25; its lint was also finer and $\frac{1}{8}''$ longer. Tanguis seemed to be stronger and more robust than other *barbadense* types, although the lint produced under Sudan irrigated conditions did not have the same characteristics as those of Tanguis grown in Peru.

Crosses of Sudan American types with Hopi Acala gave promising results in spite of severe wilt damage over the trial. Not only has strength been improved, but the yields of the crosses showed a considerable increase over the controls. Crosses are also being made to Wilds to obtain some resistance to wilt.

In the Nuba Mountains areas, although Wilds again headed the overall lint figures with an average of 266 lb. lint per acre, its superiority over the BAR 7/8 derivatives was not marked.

At Shambat combinations of factors B_2B_6 and $B_2B_3B_6$ are being introduced into the commercial cottons to increase their resistance to bacterial blight. BAR 14/49 ($B_2B_3B_6$ Sakel) and BAR 14/40 and 14/41 (B_2B_6 Sakel) have been passed to Medani for testing.

The high ovule strains (BAN lines) again outyielded BAR 14/25, and further work was carried out on the genetics of hairiness, the transfer of high lint strength from *G. thurberi,* and the transfer of leaf-curl resistance from *G. hirsutum* to blackarm resistant L and S cottons.

ADEN.

In Abyan the standard of weeding was again poor, and yields were low, only 15,000 bales being obtained from 25,000 acres (240 lb. p.a.). In contrast, Lahej gave 12,000 bales from 13,000 acres (369 lb. p.a.). Grade was better than in the three previous seasons, 85%-90% being grade 4 and over. The bulking up of BAR XL1 is proceeding, and the whole of the Protectorate crop should be of this variety by 1960.

Wild's Early again yielded well—1,149 lb. lint per acre against 750 lb. for AB control. Picking of Wilds started 107 days after sowing and 5 weeks before BAR XL1. Work continued on crossing between L and Wilds, for resistance to root rot; a fairly high measure of resistance is present in the hybrids.

Responses to nitrogen were again good (73%) and a water duty experiment with two varieties gave the following results:—

Water applied.	*Lb. seed cotton per acre.*	
(*cm.*)	*BAR XL1.*	*Wilds.*
10	415	1,126
20	1,144	2,118
30	1,688	2,495
40	1,637	3,805

The high yield of Wilds with 40 cm. water was due to the ability of the variety to produce a second crop of bolls late in the season. For BAR XL1, 30 cm. seems to be sufficient.

A preliminary experiment on the possible practice of sowing cotton before irrigation gave interesting results. Although the practice led to a drop in the number of plants per acre, the yield of seed cotton was increased by some 600 lb. The experiment is to be continued.

In any field the higher parts are more saline than the lower, as a result of evaporation, and undoubtedly the general level of the water table is a major factor controlling the development of salinity—the higher the water table, the greater the salinity. It is therefore important not to apply more water than is needed.

A survey of insect pests was carried out as far as security conditions would allow. *Diparopsis* occurred wherever boll collections were made, but was not in general a serious pest in 1957-58. *Aphis* was also found all over Abyan, being most severe in tall lush cotton; its incidence may be connected with the presence of a wild cucurbitaceous weed in the cotton fields.

A study of root rot was undertaken in October and November 1957. It is thought that continuous cotton growing on the same land,

and the leaving of infected root debris in the soil, have caused a build-up of the pathogen in the soil. The breeding of resistant varieties, soil sterilisation, added fertiliser, and agricultural practices such as rotations are suggested as means of control.

West Indies.

Much work was carried out during the season on spacing, manuring, intercropping and land use. In Montserrat nitrogen deficiency was more marked than usual; it is thought that this may be due to the change in planting date, leading to leaching of soil nitrates during the autumn rains. In St. Vincent the filtering of V135 for *Fusarium* wilt was carried a stage further, and elsewhere the maintenance scheme for MSI was continued.

The change in planting date in Montserrat and St. Kitts had the expected result on lint quality, the staple length being slightly longer and the hair weight higher, leading to a slight reduction in the count/strength product.

This season, with the sudden end to the rains in January, MSI out-yielded VH8 and VH10. The latter two strains normally give a good top crop, and so are favoured by a long growing season and show up comparatively badly in a short season such as that of 1957-58.

Bacterial blight was recorded in all islands. It was noted that where spraying against *Nezara* had taken place the amount of bacterial blight on the bolls was halved, indicating that *Nezara* may be partly responsible for transmitting this disease from boll to boll. On the other hand, regular spraying with insecticides tended to increase the transmission of the angular leaf spot phase.

In an insecticide trial in Antigua the best results were obtained from a mixture of DDT and malathion (as was the case in the Eastern Province of Tanganyika). This treatment gave a 51% yield increase over the control. In St. Vincent stainers were controlled by two or more sprayings with wettable BHC powder.

COTTON PRODUCTION

(in bales of 400 lb.)

	Record Crops		*Recent Crops*		
	Season	*Amount*	*1955-56*	*1956-57*	*1957-58*
Uganda	1937-38	417,179	363,675	372,433	350,972
Kenya	1936-37	22,166	16,297	8,182	11,547
Tanganyika	1957-58	*175,332*	133,591	169,061	*175,332*
Nyasaland	1934-35	21,006	5,734	7,000	9,180
*Nigeria	1957-58	240,861	154,436	143,431	240,861
Sudan	1956-57	704,645	528,344	704,645	272,728
Aden	1955-56	30,700	30,700	28,310	28,752
West Indies	1940-41	9,312	5,457	3,739	6,938
Total	1956-57	1,436,801	1,238,234	1,436,801	*1,096,310*

5-Year Averages.

	1921-22 to 1925-26	*1926-27 to 1930-31*	*1931-32 to 1935-36*	*1936-37 to 1940-41*	*1941-42 to 1945-46*	*1946-47 to 1950-51*	*1951-52 to 1955-56*
Uganda	128,300	159,100	271,700	345,000	208,300	295,800	352,300
Kenya	1,500	1,300	7,400	15,600	6,800	8,300	14,400
Tanganyika	16,600	22,200	42,700	61,700	39,100	48,400	97,300
Nyasaland	5,800	5,300	11,200	9,600	9,100	8,100	12,100
*Nigeria	28,900	28,600	35,500	45,400	29,100	49,100	138,900
Sudan	53,200	142,700	214,800	321,500	297,700	357,200	460,400
Aden	—	—	—	—	—	3,800	18,400
West Indies	4,800	5,200	3,600	6,800	4,800	4,900	5,100
Total	239,100	364,400	586,900	805,600	594,900	775,600	1,098,900

Figures in italics are estimates.

*Ginnery figures, not including amounts used for hand spinning.

COTTON PLANTING AND PICKING DATES

	Planting	*Picking*
Uganda	June-August	December-March
Kenya	May-August	December-February
Tanganyika:		
Lake Province	November-January	April-August
Eastern Province	February-April	July-October
Nyasaland:		
Southern and Central Provinces	December-January	June-July
Northern Province	May-June	November-December
Northern Nigeria	June-August	November-February
Sudan:		
Irrigated	August-September	January-May
Raingrown	June-August	October-February
Aden	August-October	February-May
West Indies	August-October	January-April

YIELDS OF LINT PER ACRE

The figures shown below have been included to give some idea of the yields obtained from cotton grown in different territories and under different conditions. Only those countries which publish official acreage figures have been included.

When looking at the figures it should be borne in mind that in most territories in Africa cotton is grown by peasant cultivators on small and scattered holdings, and is sometimes interplanted with other crops. In these circumstances accurate estimates of the area planted to cotton are very difficult to obtain, and this naturally makes it difficult to arrive at the true yield per acre.

YIELDS OF LINT IN POUNDS PER ACRE.

	Average 1935-36 to 1938-39	*1954-55*	*1955-56*	*1956-57*	*1957-58*
Uganda—Raingrown	94	69	91	94	86
Kenya (Nyanza) ,,	—	60	62	53	47
Nyasaland ,,	48	110	51	103	105
West Indies. S.I. ,,	122	176	195	153	205
Sudan:					
American ,,	75	112	132	93	141
Sakel—Flood	203	125	248	103	145
Gravity and pump	430	434	469	584	152
Aden, Abyan—Flood	—	220	350	227	233
Lahej ,,	—	360	592	457	320

EMPIRE COTTON GROWING CORPORATION

12 CHANTREY HOUSE, ECCLESTON STREET, S.W.1.

PUBLICATIONS

EMPIRE COTTON GROWING REVIEW.

" The Empire Cotton Growing Review " is the official organ of the Empire Cotton Growing Corporation. It is published quarterly (in January, April, July and October) and contains original articles, notes on scientific, commercial and technical literature, and specialized advertisements. The price of each issue is **5s. 0d.**

PROGRESS REPORTS FROM EXPERIMENT STATIONS.

The reports for the seasons up to and including 1950-51 were published in seasonal volumes; the following are still in print and available at **3/-** per volume.

1923-25 (one volume), 1926-27, 1931-32, 1934-35, 1935-36, 1942-43, and 1945-46 to 1950-51.

From 1951-52 the reports from each territory were published individually each season. A few of the 1951-52 reports are out of print, but all others are available at **1s.** per report or **7s. 6d.** for the seasonal set.

ANNUAL REPORTS.

The Annual Reports of the Corporation and booklets describing its work are available on application, free of charge.

BOOKS.

The Insect Pests of Cotton in Tropical Africa. E. O. Pearson. 1958. Obtainable from Commonwealth Institute of Entomology, price **40s.** (Joint publication E.C.G.C. and C.I.E.)

RESEARCH MEMOIRS.

This series comprises reprints of major scientific papers published by the staff of the Corporation since the war, as listed below. All except those marked with an asterisk as out of print are available at **2s. 6d.** each.

* **No. 1.** Breeding Cotton Resistant to Blackarm Disease. R. L. Knight. 1946.

* **No. 2.** Notes on the Classification and Distribution of Genera related to *Gossypium*. J. B. Hutchinson. 1947.

* **No. 3.** The Rôle of Major Genes in the Evolution of Economic Characters. R. L. Knight. 1948.

* **No. 4.** The Development of Internal Boll Disease of Cotton in Relation to Time of Infection. E. O. Pearson. 1948.

* **No. 5.** Observations on the Development of the Cotton Boll, with Particular Reference to Changes in Susceptibility to Pests and Diseases. R. C. Rainey. 1948.

No. 6. Experimental Methods with Cotton.—Sulphuric Acid Treatment of Cotton Seeds. Effects of Gap-filling on Development and Yield. D. MacDonald, W. L. Fielding and D. F. Ruston. Ginning Percentage and its Determination in Variety Trials. Determination of Staple Length in Single Plant Selections and Variety Trials. W. L. Fielding. 1948.

No. 7. Jassid Resistance and Hairiness of the Cotton Plant. F. R. Parnell, H. E. King and D. F. Ruston. 1949.

LIST OF PUBLICATIONS

No. 8. Response of Cotton to Leaf-Curl Disease. J. B. Hutchinson, R. L. Knight and E. O. Pearson. 1950.

No. 9. Confidence Limits of Expected Monthly Rainfall. H. L. Manning. 1951.

No. 10. The Distribution of Wild Species of *Gossypium* in the Sudan. R. L. Knight. The Cytological Relationships of *Gossypium somalense:* Gürke. H. Douwes. 1951.

No. 11. The Evolution of Blackarm Resistance in Cotton. R. L. Knight and J. B. Hutchinson. 1951.

No. 12. Intra-Specific Differentiation in *Gossypium hirsutum.* J. B. Hutchinson. 1951.

No. 13. The Genetics of Withering or Deciduous Bracteoles in Cotton. R. L. Knight. Colchicine Treatment of Young Cotton Seedlings as a Means of Inducing Polyploidy. H. Douwes. 1952.

No. 14. The Genetics of Jassid Resistance in Cotton. I. The Genes H_1 and H_2. R. L. Knight. 1952.

No. 15. Bacterial Blight of Cotton. G. M. Wickens. 1953.

No. 16. The Cytological Relationships of *Gossypium areysianum* Deflers. H. Douwes. 1953.

No. 17. (a) A Cotton Stainer (*Dysdercus superstitiosus* Fabr.) as a Potential Pest of Sorghum. (b) Studies of *Lygus vosseleri* Popp. (Heteroptera, Miridae). A Pest of Cultivated Cotton in East and Central Africa. (c) The Sorghum Midge, *Contarinia sorghicola* (Coq.), in East Africa. Q. A. Geering. 1953.

No. 18. The Genetics of Jassid Resistance in Cotton. II. Pubescent T611. III. The Kapas Purao, Kawanda *punctatum* and Philippines Ferguson Group. IV. Transference of Hairiness from *Gossypium herbaceum* to *G. barbadense.* R. L. Knight and J. Sadd. 1954.

No. 19. New Evidence on the Origin of the Old World Cottons. J. B. Hutchinson. 1954.

No. 20. The Biology of Red Bollworm, *Diparopsis watersi* (Roths.), in Northern Nigeria. Q. A. Geering and A. F. H. Baillie. 1955.

No. 21. Cotton Breeding in the Sudan. R. L. Knight. 1955.

No. 22. Botanical Studies in Cotton Quality. J. P. Evenson. 1956.

No. 23. The Statistical Assessment of Rainfall Probability and its Application in Uganda Agriculture. H. L. Manning. 1956.

No. 24. Vascular Infection of Cotton by *Xanthomonas malvacearum* (E. F. Smith) Dowson. G. M. Wickens. 1956.

No. 25. On the Estimation of Water Losses by Evaporation under Equatorial Conditions. Sir Joseph Hutchinson and H. G. Farbrother. 1956.

No. 26. Yield Improvement from a Selection Index Technique with Cotton. H. L. Manning. 1957.

No. 27. On an Electrical Resistance Technique for the Study of Soil Moisture Problems in the Field. H. G. Farbrother and L. E. Harrisson. 1957.

No. 28. Studies of Crop Loss following Insect Attack on Cotton in East Africa. K. S. McKinlay, Q. A. Geering and T. H. Coaker. 1958.

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MISCELLANEOUS.

A very large number of papers written in whole or part by members of the staff have not been reprinted as Memoirs, and are not in general available for sale. A complete list of such papers published in the last few years is printed below.

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